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A CASE OF ABSOLUTE TONE MEMORY.

BY ARCHIBALD HOGG.

EXTRAORDINARY forms of consciousness are necessarily few, otherwise they would not be extraordinary. They are usually worthy of study and report directly by reason of inherent interest and indirectly through the light they throw on mental process in general. Among the exceptional forms of memory activity we find in hearing what is called by musicians "recollection of absolute pitch," by psychologists "absolute tone memory." A striking instance of the possession of this faculty led the writer, assisted by a friend[1] who is a skillful amateur violinist, to make the two tests herewith reported.

The subject[2] is a boy thirteen years of age, a quiet, gentle lad, imaginative, introspective, fond of his music and of long walks, and is perhaps less vigorous than the average child of the same age.

He gave early evidence that he possessed unusual musical gifts. One night when he was about four years old, and while lying in bed, he listened to the playing of a wedding march at a marriage ceremony in a neighbor's house. The next morning he climbed on the piano stool at home and reproduced the march—but in a simpler way. At the age of six his musical education began with lessons on the piano, and it has continued ever since except when interrupted by the vacations and illnesses incident to childhood. His possession of absolute tone

1. Mr. A. K. Hubbard, assistant professor of civil engineering in the University at the time.

2. The boy is the son of a professor in our University. Both parents are musical. One older brother plays the cello, another plays violin. Two younger children cannot be characterized with much certainty yet with respect to musical ability.

memory was so strikingly emphasized as to attract attention one day about three years ago, when he remarked to an older brother who had just tuned a cello that the pitch of the instrument differed from that of a few days before—an observation that was verified by appeal to the piano. Since then the boy has been tested, usually for amusement or out of curiosity, some five or six times, but without any records being kept. Composition comes easy to him and he has composed not a few melodious pieces during the last four or five years.

The notes given in the tests and the observer's judgment are indicated in accordance with a quite simple plan. The notes from and including middle C to its octave above are left unmarked. A tone in the next higher octave is indicated by a single accent mark above the letter, in the second higher by two accents placed above, and so on; similarly with the lower octaves, except that the accent marks are placed below the letter in such instances. The usual symbols for sharp and flat are used after the prescribed fashion.

The note or notes struck are placed first in the record and are followed immediately by the observer's judgment. In both tests the observer himself was seated with back turned at a distance of about eight feet from the instrument and was looking away from it. In other and unrecorded tests at home he has been sent at different times to various places about the house within hearing distance of the piano. The results of the unrecorded tests have been practically the same, as conversation with people present on such occasions has revealed. The uniformity of testimony regarding these unrecorded tests is the reason why more tests were not made by the present experimenters.

The first test was made on the observer's piano in April of this year. The results are given in table I.

Several times the observer was asked not to name the notes but to come to the piano and point them out without striking the keys. It was doubtless an unnecessary precaution.

A few miscellaneous tests were next made. The observer was asked to reproduce, either by whistling or singing, certain notes that were named, and thereupon sang or whistled in correct pitch, as shown by the piano, the following notes,

f♯′, g♯, c♯′, b♭, f, b‴ a″, d.

Following that a simple tune was played on the violin and the key asked for. It was promptly and correctly given. The

TABLE I.

Stimulus.	Judgment.	Stimulus.	Judgment.
C	C	$D_{,}$	$D_{,}$
E	E	F B♭	F B♭
A'''	A'''	$B_{,}$ G	$B_{,}$ G
D''	D''	G G♯	A♭ A
$B_{,,,}$	$B_{,,,}$	$E_{,,,}$ $G_{,,,}$	———
G'	G'	B''' F'''	B''' F'''
$F_{,,,}$	$F_{,,,}$	$G_{,,}$ $B_{,,}$ $D_{,}$ $G_{,}$	$G_{,,}$ $B_{,,}$ $D_{,}$ $G_{,}$
B'''	B'''	$E♭_{,,}$ $G_{,,}$ $B♭_{,}$ $D_{,}$	$E♭_{,,}$ $G_{,,}$ $B♭_{,}$ $D_{,}$
$D♯_{,,,}$	$D♯_{,,,}$	C F♯	C F♯
G'''	G'''	$E_{,,,}$ G'''	$E_{,,,}$ G'''
$A♭'$	$A♭'$	$D_{,}$ C♯	$D_{,}$ C♯

experimenters having an idea as to the method of recognition, parts of three or four tunes were played, care being taken not to stop on the key note. The recognition was again prompt and accurate. Being questioned, the observer said his judgment in the first instance was determined by following the general rule that a simple melody ends with the key note. In the subsequent selections the judgment was determined by the sequence of the notes.

Then a high note on the violin between b♭″ and b″ was struck. When asked the pitch the observer mentioned b″, and upon being told it was not exactly that he named b♭″.

Next, several double stops were given on the violin, one note being a shade off the key in each case. The note that was in error and the direction in which it should be changed were correctly given. The observer was now asked to direct the operation of tuning the A string of the violin until it corresponded with his own piano. The result, as shown by the piano, proved that the judgment was slightly in error in the flat direction. The same test on the D string gave a correct judgment. Practice with the A string doubtless helped here.

Lastly, the opening notes of a piece were sung. They were named correctly by the observer, as appeal to the piano demonstrated. He is ignorant of fingering of the violin.

The second test was made one afternoon about a month later with the piano used twice a week by the observer when he

takes his music lesson. The instrument is tuned to international pitch and is lower than his own. He said it sounded flat. The results are in table II.

TABLE II.

Stimulus.	Judgment.	Stimulus.	Judgment.
C♯	C	G'''	G'''
G_{III}	G_{III}	$A♭'$	G'
A'''	A'''	D_{I}	D_{I}
D''	D''	$A♭'$	G'
$B♭_{III}$	$B♭_{III}$	$G♯'''$	G'''
G_{I}	G_{I}	F B♭	E A
B♭	B♭	$B♭_{I}$ G	$A♯_{I}$ F♯
$D♯'''$	D'''	C F♯	B F
$F♯'''$	F'''	G_{II} B_{II} D_{I} G_{I}	G_{II} B_{II} D_{I} G_{I}
F_{III}	F_{III}	$G♯''$ $B♯''$ $D♯'''$ $G♯'''$	G'' B'' D'''
B'''	B'''	G'' $B♭''$ D'' F'''	$F♯''$ A'' $C♯'''$
$D♯_{III}$	D_{III}	E♭ G B♭ D	D F♯ A C

With the first of the errors it occurred to the experimenters that the judgments were being determined exclusively by simple comparison with the image-standards from the home piano—an hypothesis which would have involved uniformity in the errors. Notes a half tone lower in pitch than those really given should have been named.

Later it occurred to us that the observer himself might be trying to correct the difference between the two pianos. That this was usually the case became known from answers to questions asked after the test. The observer arrived at most of his judgments by traveling the following mental highway: The tone was first identified and named by means of the images from his own piano—the instrument on which he daily played and with which his familiarity was great. Having thus identified the tone as nearly as possible (exact correspondence in any instance would be highly improbable), the simple addition of a half tone brought about the judgment announced.

In a few cases direct recall of the tone-images from the teacher's piano rendered any additional mental labor unnecessary to identification.

In closing, a few statements are made by way of addition and partial summary. For our observer the difficulty of identifying a single tone is scarcely harder in one region of the piano scale than another. But there is a decided difference in ease of analysis according as there are high or low complexes of tones. In the third octave below the mental separation of two notes was not attempted, the remark being made, "It's such a jumble, I can't remember," while in the third above the identification was made with accuracy and without a noticeably great amount of concentration. Images from the organs of utterance seemed to play no part whatever in his recall of tones. Sound images apparently furnished exclusively the material used in all the judgments. Upon being questioned as to his method of identification and of reproduction the observer said he "just heard the tones in his head and told in that way." Of a piece of music recently purchased for him he said he had played it off "in that way" before touching a finger to the piano. His introspective competency was greater than was expected.